

## **ISMS Assessment Form BNL Focused Management Review**

**Objective:** Assess the adequacy of the institutional work control requirements and the effectiveness of their implementation by BNL's Collider-Accelerator Department (C-AD). Assess line management's role in effectively translating institutional requirements into clear work direction for conducting effective hazard analyses, implementing appropriate changes to hazard controls, and developing effective designs, work plans and job tasks. Assess the effectiveness of the institutional and facility continuous improvement processes and the use of lessons learned to improve the facility and institutional work planning and control process. Review and assess field supervision of work execution and changes to work tasks as well as management's effort in assuring work is performed within controls. Particular emphasis will be placed on examining the institutional and facility expectations and rigor in the review and approval of hazard analysis and controls, and work plans and/or permits in authorizing work.

Objectives were met by document review, interviewing departmental personnel and observations of work in progress.

The mission of the Collider-Accelerator Department is to develop, improve and operate a suite of five particle / heavy ion accelerators to carry out a program of accelerator-based experiments at BNL. In addition, experimental support is provided to an international community of over 1500 scientists and new accelerator facilities are designed and constructed in support of BNL, DOE, and national missions. It is a large, complex and varied department relying heavily on approximately 900 procedures contained in the Collider-Accelerator Department Operations Procedures Manual. Estimates obtained from departmental personnel indicated that roughly 50% of all work tasks are accomplished through implementation of procedures; 10% through work permits, which are required for medium or high hazard jobs; and the remaining 40% through skill of the worker. Skill of the worker jobs require only that technical supervisors enter the task into their logs, resulting in a scarcity of documentation for this category of work.

- 1. Identification of Safety Standards and Requirements: Analyze the Hazards and Hazard Controls Tailored to Work Being Performed; Develop and Implement Hazard Controls**  
**Core Function #2:** *"Hazards associated with the work are identified, analyzed and categorized."* **Guiding Principle #5:** *"Before Work Is Performed, the Associated Hazards Shall Be Evaluated and an Agreed Upon Set of Safety Standards Shall Be Established That, if Properly Implemented, Will Provide Adequate Assurance That the Public, the Workers, and the Environment Are Protected from Adverse Consequences".* **Guiding Principle #6:** *"Administrative and Engineering Controls To Prevent and Mitigate Hazards Shall Be Tailored to the Work Performed and Associated Hazards."* **Core Function #3:** *"Applicable Standards and Requirements are Identified and Agreed Upon, Controls to Prevent/Mitigate Hazards are identified".*

ES&H functions and activities are integrated into program, activity, and work planning at all levels of the line organization. Prior to the initiation of work, line management identifies, analyzes, and categorizes the hazards associated with the work activity so that the appropriate administrative and engineering controls

can be put in place to prevent or mitigate those hazards. Line management has established processes for identifying and tailoring controls for hazards associated with all facilities, operations and activities. Hazard controls are established based on the understanding of the hazards, vulnerabilities, and risks in the work environment (e.g., nuclear, radiological, chemical, industrial, physical, and natural phenomena). Clear Roles and Responsibilities, Guiding Principle 2, for providing direction, analyzing hazards, and developing and implementing hazard controls will be assessed in management's implementation of the criteria and measures below.

### **1.1 Effective Evaluation of Hazards & Establishing Controls (Work Permit, SOP, JRA, and JSA Processes)**

C-AD has approximately 30 Job Risk Assessments posted on their web site. These are written in a generic way to apply to similar classes of activities. In addition, there is approximately the same number of Facility Risk Assessments to cover activities within the various departmental components. The JRAs were developed with multidisciplinary involvement, with workers, technical supervisors, group leaders and managers participating. Reviewed annually as part of the OHSAS 18001 process, these represent a formalized planning tool for the department. Once developed, however, JRAs are rarely referenced by the planning documents used by workers. **(O 1.1-1)** C-AD has approximately 900 departmental procedures. Roughly 100 of these are reviewed annually, with the rest having review cycles of no more than three years. All procedures are reviewed upon the implementation of significant changes.

Work permits examined, which are required for medium or high hazard jobs, were generally complete in identifying hazards and calling out the associated work controls. Some inaccuracies were noted in the approximately fifty permits reviewed in detail. The rigor of review, coordination and the level of controls applied correlated well with the hazard and complexity of the task. It should be noted that while some personnel interviewed maintained that this applied to skill of the worker jobs as well, no formal documentation is available to support this.

Work plans contained in the Work Permits are often brief and do not completely describe the tasks to be performed. **(O 1.1-2)** Personnel rely on verbal communication in those instances where detailed procedural direction is not provided in an attachment. In some C-AD groups, where skill of the worker jobs (low ES&H risk/ /low complexity/low coordination) are performed, the supervisor may not provide any written form of instruction to the worker(s).

In other C-AD groups, all work assignments are processed using the Enhanced Work Permit to describe the task, assess the hazards, determine the controls, and assign the workers. This later process is not required by the BNL SBMS, but for those groups that use this documented work control process, workers stated that this formality provides assurance that the work task has been defined, hazards have been adequately assessed, and controls are identified and established. This document is then reviewed by the workers thereby ensuring good communication of controls.

A job walk down is required for all medium and high hazard jobs. Technical supervisors, who also serve as work control coordinators, typically conduct these. Facility Support personnel and the Work Control Manager provide subject matter support for health physics and industrial hygiene respectively. Walk down team composition for work permits examined appeared appropriate.

Expectations for conducting walk downs have not been formalized in C-AD. Personnel stated that they relied on their work experiences in performing walk downs before they commenced the actual work. Although C-AD has a draft OPM procedure on conducting effective pre-job briefings and post-job reviews based on information from the Institute of Nuclear Power Operations (INPO), they have not considered also utilizing INPO resources for good practices for conducting walk downs. **(R 1.1-1)** Walk downs provide an opportunity to verify that the essential aspects of a job are addressed, as well as the physical characteristics of the work area. Well-executed walk downs can provide the added benefit of improving safety and efficiency in the performance of the task.

The processes required by SBMS and CA-D implementing procedures for work planning and control were observed to need improvement to be effective in identifying hazards and controls.

## **1.2 Appropriateness of Controls - Applied controls are commensurate with the nature of the hazard, and the Laboratory level tools provided to support identification of hazard controls are used appropriately**

Several work permits reviewed had vague or incomplete descriptions of the task to be performed, relying instead on knowledgeable, experienced personnel and informal coordination to successfully accomplish the job. Revisions to some permits were noted, usually initialed by the Work Control Manager.

Hazard levels are determined through the application of the SBMS Hazard Analysis subject area, with departmental implementation accomplished through OPM Procedure 2.28, C-A Procedure for Work Planning and Control of Operations, and aided by an attachment to this procedure, 2.28d, Work Screening Guidance. Work permits reviewed were appropriately graded for hazard levels.

Only one high hazard job, which requires a Job Safety Analysis (JSA), was available for review. The records supplied did not meet the format and content of a JSA as defined by the BNL's Standards Based Management System. (Reference: ESH 1.5.0, Appendix III) **(F 1.2-1)**

The processes required by SBMS and CA-D implementing procedures for work planning and control were observed to need improvement to be effective in identifying hazards and controls.

## **1.3 Involvement of Workers - Personnel involved in implementing controls and task execution are involved in the work planning process as appropriate**

Permits reviewed contained signatures of workers, and those interviewed maintained that they had good opportunities to provide input on job hazards and controls, as well as the method of successfully accomplishing the tasks assigned. All working level personnel interviewed were aware that their management wanted and encouraged their input on job safety and expected work to be carried out within the agreed-upon controls.

Walk downs are required for medium and high hazard jobs, and are performed more frequently than previously for skill of the worker tasks. These provide the opportunity for workers to understand the scope of the job and review the hazards present as well as appropriate controls. Workers valued walk downs as an extremely useful tool in understanding exactly what the task involved. The JRA process has increased worker involvement in the work planning process as have the more frequent use of job walk downs. There are, however, no expectations formalized for performing walk downs, and one worker suggested that walk downs be conducted further in advance of work commencing. **(O 1.3-1)**

The processes required by SBMS and CA-D implementing procedures for work planning and control were observed to be effective in involving personnel in the planning process.

**1.4 Adequacy of Scope Definition and Planning Documentation - All aspects of the work are defined in detail; work planning documentation is complete and accurately describes the planned work, its hazards, and proposed controls; related permits are complete and current**

As addressed in previous sections, some work plans associated with work permits were vague and did not describe the tasks to be performed in detail. The high hazard job reviewed, requiring a JSA, did not meet the format and content specified in SBMS. Documentation for skill of the worker jobs is inadequate to fully describe planned work, its hazards and controls. A variety of other permits may be required for any particular job. When any of these were called out, they were present and current.

The processes required by SBMS and CA-D implementing procedures for work planning and control were observed to need improvement to be effective in scope definition and planning documentation.

**2. Operations Authorization; Perform Work Within Controls**

Guiding Principle #7: *"The Conditions and Requirements to be satisfied for Operations initiated and Conducted Shall Be Clearly Established and Agreed-Upon.* Core Function #4: *"Readiness is Confirmed and Work is Performed Safely."*

Line management has established and implemented processes to confirm that a facility or work process/activity, as well as the work force, are in an adequate state of readiness prior to authorizing the performance of work. All work activities, including maintenance modifications, are subject to authorization based on appropriate review of the preparation and readiness to perform work. Line managers are responsible for implementing programs in compliance with defined requirements. Line managers ensure that contractors and subcontractors

execute defined requirements in such a manner that employees, the public, and the environment are protected from adverse consequences. Clear Roles and Responsibilities, Guiding Principle 2, for providing direction, authorizing work, performing work within controls and managing changes in work conditions will be assessed in management's implementation of the criteria and measures below.

## **2.1 Confirmation of Readiness - Readiness is rigorously confirmed, personnel are fully aware of the hazards and associated controls, and any actions necessary as a condition of authorizing work are effectively addressed**

Based on interview results and the examination of work permits, pre-job briefs are conducted on moderate and high hazard tasks, and are frequently performed on low hazard (skill of the worker) activities. Input from workers indicated that pre-job briefs were becoming more common than in the past, and provided value to them in assessing the task to be performed. A draft procedure based on INPO good practices is in development for both pre-job briefings and post-job reviews. There was no documentation, however, showing the conduct of pre-job briefs for low hazard work. **(O 2.1-1)**

Authorization to begin work for jobs covered by work permits was clear, with appropriate reviews in place. Changes noted were usually initialed by the work control manager. However, there is little documentation of any changes made to the original work plan for low hazard jobs. **(O 2.1-2)**

All observations and interviews indicated that personnel knew the hazards associated with the job, the controls called into place and the limits on their authorization to perform work. Several examples of issues that would cause a worker/technical supervisor to reassess a job were noted during interviews.

No instances were noted where pre-start conditions were not satisfied for skill of the worker tasks. The usual caution applies that the sparse documentation that exists for low hazard work makes this criteria difficult to assess.

Within the limits imposed by existing documentation, the processes required by SBMS and CA-D implementing procedures for work planning and control were observed to be effective in confirmation of readiness.

## **2.2 Clarity of Authorization - Work authorization is explicit and the associated limits under which work is to be performed are specific**

Some work permits have vague, incomplete descriptions of the work requested (work plan). There is, instead, reliance on knowledgeable, experienced personnel and informal coordination to accomplish the task.

Awareness and authorization of work by the building managers is not formally required. Job supervisors are expected to communicate with the appropriate personnel to ensure that the work will proceed safely and efficiently. Informal communications may mitigate this issue to some extent. **(O 2.2-1)**

The majority of work packages reviewed and the work activities observed indicated that those involved had an adequate understanding of the job scope and what the authorization to begin work covered.

All personnel interviewed maintained that they and their staff (if applicable) understood the limits and conditions that would necessitate additional safety review and re-authorization of the task.

Within the limits of existing documentation, the processes required by SBMS and CA-D implementing procedures for work planning and control were observed to be effective in clarity of authorization.

### **2.3 Conduct of Work Consistent with Authorization - Work is explicitly performed consistent with the limits of authorization**

Work permits examined that called out specific controls, for example personnel monitoring, provided evidence that those controls had been employed. The majority of work observed had appropriate controls in place, however, one instance was noted during interviews where a Plant Engineering worker neglected to add a required additional lockout. **(F 2.3-1)** Although a walk down was required, and the work permit listed a Lockout/Tagout, three workers relied on the locks of fellow crafts persons while they performed their tasks in a C-AD building. The Plant Engineering manager and division safety professional promptly issued notifications that failure to use required locks and tags was an unacceptable work practice. Plant Engineering provided supplemental refresher training for personnel. C-AD personnel were unaware that PE personnel had not hung the required Lockout/Tagout.

Near misses and other incidents were captured in excellent fashion if they rose to the level of invoking a formal critique, however, while instances of this occurring during the conduct of low hazard work were noted during interviews, there is no formal mechanism to capture and document lower level lessons learned. **(O 2.3-1)** Similarly, there is no measure of how often work control limits were violated unless the incident generated a formal critique.

In C-AD Technical Supervisors serve as work control coordinators. While this may present subtle conflicts in balancing timely accomplishment of the tasks assigned against the full application of controls, this does assure that the work control coordinators are in the field while jobs are being performed. C-AD's Work Control Manager has an active field presence and interacts frequently with work control coordinators.

All tasks during shutdown of the accelerators are maintenance, upgrades, etc. As such, most are smaller job tasks and the presence of technical supervisors would be an almost continuous review for the short durations typically involved.

The processes required by SBMS and CA-D implementing procedures for work planning and control were observed to need improvement in conduct of work consistent with authorization.

## **2.4 Response to Unanticipated Conditions - Unintended events are expeditiously and appropriately addressed to ensure that the safety of the work and the personnel performing the work are maintained**

All personnel interviewed and/or observed had an adequate knowledge of stop work authority. In addition, all workers knew to reassess the job with their supervisor if appropriate job boundaries would be crossed. Several examples of instances were reported where this process had occurred. This constitutes a common sense mechanism to hold work activities until any uncertainties are resolved.

One recent example of personnel placing a temporary hold on work was C-AD personnel had noticed an unusual sound from a high voltage pulse capacitor. BNL contacted the vendor and learned that the unfamiliar sound was due to a previously unknown failure mode. Safe work practices were developed, and the lessons learned were formalized in a C-AD procedure.

As expected, the formality of operations, supervisory and subject matter oversight, level of review, etc. are keyed to the hazards involved and the complexity of work being considered. This is traceable in medium and high hazard work, however, the only records available from low hazard tasks are short notes in the technical supervisors' logs.

The processes required by SBMS and CA-D implementing procedures for work planning and control were observed to be effective in response to unanticipated conditions.

## **3. Provide Feedback and Continuous Improvement Core Function #5:** *"Feedback Information on the Adequacy of Controls is Gathered, Opportunities for Improving the Definition and Planning of Work are Identified and Implemented, Line and Independent Oversight is Conducted, and, If Necessary Regulatory Enforcement Actions Occur"*

Line management has established formal mechanisms and processes for collecting both qualitative and quantitative information on ES&H performance. This information is collected and used effectively as the basis for informed management decisions to improve safety performance through assessments, performance measures, and other feedback mechanisms. Review the Department processes for collecting and assessing safety-related performance (e.g., the Tier I Inspection Program). Line management has established formal methods to identify deficiencies and noteworthy practices with generic applicability, disseminate these lessons learned within and across organizations, and incorporate them into procedures and work control documents for subsequent work activities. Clear Roles and Responsibilities, Guiding Principle 2, for continuous improvement of the work planning and control process will be assessed in management's implementation of the criteria and measures below.

### **3.1 Meaningful Mechanisms for Personnel Input - Mechanisms for personnel to provide input to the work planning and control process are meaningful, personnel are aware of these mechanisms, and these mechanisms are routinely used. Personnel input to the work planning and control process**

**substantially contributes to improving the overall process and its effectiveness**

All personnel interviewed (Technical Supervisors, workers, and facility support) indicated that they had adequate input to the work planning process. Some of the managers and workers interviewed acknowledged that they had participated in the development of JRAs and Facility and Area Risk Assessments (FARAs) and had concluded that these processes were useful and insightful into determining hazards and controls as well as providing opportunities to perform the work safer and more efficiently. C-AD personnel categorized the JRAs as management tools in the planning of the work phase and not used for reviewing hazards and work controls prior to performance of the work. Personnel believed that the JRAs covered essentially all the work activities being performed and that the annual reviews were an indication by management that it was important to keep these tools up to date.

Post-job reviews were infrequently documented (fewer than 10%) on the work permits completed in CY 2005. From interviews, personnel stated that the jobs usually proceeded according to the work plan and that there was either no need or value in documenting that fact on the work permit. In some instances, where the work permits were written for significant tasks, the C-AD Work Control Manager has taken a more active role in obtaining a documented post-job feedback. The September 2004 self-assessment concluded that worker feedback needs to be addressed during the next Worker Occupational Safety & Health (WOSH) Committee meeting. The December 2004's Internal Audit and Oversight assessment of C-AD's work planning and control operations also identified that fewer than 10% of the completed work permits had documented post-job observations. C-AD is not effectively using the post-job review process to improve performance. **(O 3.1-1)**

In several instances, C-AD has formally instituted new procedures as well as procedure improvements following significant events or undesirable conditions. For example, following the Stanford Linear Accelerator Center (SLAC) Type A Accident of October 2004, C-AD expended significant effort in improving their compliance with NFPA 70E through procedure revisions, additional training, purchasing equipment, and strengthening work practices. As a corrective action to prevent recurrence of incidents or improve performance, C-AD instituted procedures or revised existing procedures to improve rigging practices, cable installation, window change out at Brookhaven Linac Isotope Producer (BLIP), and maintenance of cryogenic components.

The processes required by SBMS and CA-D implementing procedures for work planning and control were observed to need improvement in ensuring worker feedback.

**3.2 Value of Line Oversight – Line oversight of work is dominant source of information on system performance and improvement. Management and supervisor identify areas for improvement that substantially contribute to improvements in the overall work planning and control process.**



Technical Supervisors initiate the majority of the work permits and job assignments. Workers and supervisors acknowledged in interviews that supervisors are often present at the work site and available for clarification of work. Records of work in progress reviews are not maintained.

Through BNL independent and C-AD self-assessment reviews, the low frequency of post job reviews has been acknowledged. Progress on improving this has been slow. Workers stated that most jobs proceed smoothly, and those which do not, corrective actions are taken, but are usually not documented in the EWP. For skill of the worker jobs where no EWPs maintained, no records of worker feedback are maintained.

The processes required by SBMS and CA-D implementing procedures for work planning and control were observed to be effective in line oversight.

### **3.3 Lessons Learned addresses findings from independent assessments as well as trend indicators and occurrences from sources outside direct line supervision**

Following the Stanford Linear Accelerator Center (SLAC) Type A Accident of October 2004, C-AD expended significant effort in improving their compliance with NFPA 70E through procedure revisions, additional training, purchasing equipment, and strengthening work practices. In addition to reviewing events from within the accelerator community, the Environment, Safety, Health and Quality Directorate provides an additional source of external lessons learned to C-AD.

C-AD personnel annually review events for trends, but have not determined any adverse trends due to weak work planning and control issues. Within C-AD there are various methods for controlling low hazard work, ranging from listing of tasks in a Technical Supervisors notebook, maintaining tasks in a computer database, to completing the EWP. C-AD has not identified that this variability has had an adverse impact on operation or safety of workers. During a self-evaluation in 2004, one C-AD member noted that the inconsistent work planning systems and formality among C-AD's divisions creates the impression that C-AD staff members are not working by the same safety standards.

Given the size, complexity, hazards present and the capital investment in C-AD, a greater formality in planning and documenting low hazard jobs has the potential for increased worker safety and reducing human performance problems.

C-AD has recently implemented a Corrective Action Verification Ticker Card for the review of ATS items. The assigned individual works with the ESH&Q Head to choose at least 10 closed items from the current year to verify the stated action was actually completed and that the action actually fixed the problem. Although this corrective action verification tickler card has some elements of an effectiveness review protocol, the following key characteristics are missing:

- a) that the corrective actions are the ones which are those which will prevent recurrence of the undesirable condition
- b) that the implementation has been timely

c) that the condition of the corrective action has been adequately challenged.

BNL should consider reviewing the INPO database for good practices in developing a formalized effectiveness review process. **(R 3.3-1)**

The processes required by SBMS and CA-D implementing procedures for work planning and control were observed to be effective in addressing lessons learned from external sources.

#### **Findings:**

- F 1.2-1** In an Enhanced Work permit where a Job Safety Analysis was required, the JSA did not meet the format and content as defined by the BNL's Standards Based Management System. (Reference: ESH 1.5.0, Appendix III)
- F 2.3-1** In one instance, Plant Engineering workers failed to comply with the Work permit requirements of placing their lockout on a de-energized system. (EP-ES&H-103 and BNL ESH 1.5.1)

#### **Observations:**

- O 1.1-1** JRAs are rarely referenced by the planning documents used by workers.
- O 1.1-2** Work plans contained in the Work Permits are often brief and do not completely describe the tasks to be performed.
- O 1.3-1** There are no expectations formalized for performing walk downs.
- O 2.1-1** There was no documentation showing the conduct of pre-job briefs for low hazard work.
- O 2.1-2** There is little documentation of any changes made to the original work plan for low hazard jobs.
- O 2.2-1** Awareness and authorization of work by the building managers is not formally required. Job supervisors are expected to communicate with the appropriate personnel to ensure that the work will proceed safely and efficiently. Informal communications may mitigate this issue to some extent.
- O 2.3-1** There is no formal mechanism to capture and document lower level lessons learned.
- O 3.1-1** Post-job reviews are infrequently documented. Although BNL self-identified this in 2004, C-AD has not effectively addressed this opportunity for improving work planning and control.

**Recommendations:**

- R 1.1-1** Although C-AD is in final preparations for deploying an OPM on conducting effective pre-job briefings and post-job reviews based on information from the Institute of Nuclear Power Operations (INPO), C-AD had not considered also utilizing INPO resources for good practices for conducting walk downs.
- R 3.3-1** BNL should consider reviewing the INPO database for good practices in developing a formalized effectiveness review process.

**Noteworthy Items:**

None

**Records Reviewed:**

- Monthly Project Status Report, Revised June 21, 2005
- Cryogenic Group Work Log -- March 2005 to August 2005
- Summary of Comments from the C-A Users Safety Self-Evaluations, dated December 9, 2004
- Emails from Plant Engineering Manager & Safety Professional regarding Failure to Use Lockout/Tagout (Lesson Learned), August 25, 2005
- C-AD Tickler Card No. 304: Corrective Action Verification, dated August 10, 2005
- ESH 1.5.0 Appendix III. Job Safety Analysis, Rev 4, February 2003
- JRA 15-05, Handling of mixed and radioactive wastes at C-AD from identification to transport to BNL Waste Management, Rev 0, January 27, 2005.
- Work Planning & Controls (Assessment #2004-184), September 23, 2004
- Internal Audit & Oversight Independent Assessment IO 04-08, Work Planning & Control (WP&C) for operations in the Collider-Accelerator Department, December 8, 2004
- Summary of Comments from C-A Safety Self-Evaluations, December 16, 2004
- C-A-OPM 2.28, C-A Operations Procedures Manual, C-A Procedures for Work Planning & Control for Operations, Rev 8, May 18, 2005
- C-A-OPM 2.28i, C-A Operations Procedures Manual, Conducting Effective Pre-Job Briefings & Post-Job Reviews, DRAFT, Rev 00, August 5, 2005
- C-A-OPM 2.29, C-A Operations Procedures Manual, C-A Procedure for Enhanced Work Planning for Experimenters, Rev 03, May 26, 2004
- C-A-OPM 1.5.1, C-A Operations Procedures Manual, Disconnected Cable Policy, Rev 01, April 21, 2005
- C-A-OPM 1.5, C-A Operations Procedures Manual, Electrical Safety Implementation Plan, Rev 10, March 25, 2005
- C-A-PP005, C-A Department, RHIC Beam Abort Kicker High Voltage Modulator High Voltage Pulse Capacitor Maintenance and Replacement Procedure, Rev 01, April 1, 2005
- C-A-OPM 1.2.1, C-A Operations Procedures Manual, Cable-Pulling Safety Procedure, Rev 00, September 16, 2004 (result of critique CR-CA-2004-01)
- C-A-OPM 8.25, C-A Operations Procedures Manual, C-AD Incidental Rigging Procedures, Rev 00, June 16, 2005 (result of rigging lessons learned)

- C-A-OPM-ATT 7.1.65.a, C-A Operations Procedures Manual, Safety issues Associated with Cold Box 3, Rev 01, March 4, 2005
- Operator's Trouble Report TR #013020051842, Problem with QPAs, January 30, 2005
- Work Sheet for Repair of QPA Power Supply, C-AD Power Supply Group
- Safety Review Sheets for C-AD Power Supply Group, January 26, 2005
- Microsoft Project Schedule from C-AD Power Supply Group, August 23, 2005
- C-AD Facility & Area Risk Assessments
- Work Control Coordinator Training on "Work Planning & Control for Operations" ES&H Std 1.3.6, dated October 31, 2000
- Lesson Learned Communication: Safe Handling of Failed Capacitor in An Open Circuit State Which may Be Storing Trapped Energy, March 8, 2005
- Lesson Learned Memo: Use of "Wiggins" Type Solenoid Voltage Detectors, December 14, 2004
- Lesson Learned Memo: Inadequate labeling and Documentation of Received packages prior to Rigging, January 25, 2004
- Lesson Learned Memo: Use of Armored cable in Contact with Non-armored Cable / Abandoned Cable in Tray, November 16, 2004 (result of Critique CR-CA-2004-0015)
- C-AD Enhanced Work Planning Log for CY 2005
- Enhanced Work Permit, Work on cryogenic equipment, August 1, 2005
- Enhanced Work Permit SS2005-085, Move Rad Components in B line hot cell to inner Mongolia, May 26, 2005
- Enhanced Work Permit SS2005-106, Plumbing – Install chill water isolation valves, July 7, 2005
- Enhanced Work Permit SS2005-033, Change electric motor roto-flow skid #1, January 4, 2005
- Enhanced Work Permit SS2005-062, Repair N2 Leak, March 7, 2005
- Enhanced Work Permit SS2005-111, Opening of RHIC Valve Box, July 21, 2005
- Enhanced Work Permit SS2005-043, Decon & Depost, January 31, 2005
- Enhanced Work Permit SS2005-081, Install laser, May 4, 2005
- Enhanced Work Permit SS2005-058, Repair MM @ I-20 – AGS, March 2, 2005
- Enhanced Work Permit SS2005-120, Remove Flow Restrictions & Replace with Control Valves, August 3, 2005
- Enhanced Work Permit 05-0081, Repair & Replace Heat Exchanger, January 18, 2005
- Enhanced Work Permit 05-0083, Removal Oil Skid #4, May 25, 2005
- Power Distribution Group Work Order Job # 04-11-13, (EWP SS2004-203), November 22, 2004, Remove Spot Lights & Electrical Conduit
- Power Distribution Group Work Order Job # 0-08-18, (EWP) August 19, 2005, Replace Dist Panels AD 21 & AL 22B (PE Crews will do work)
- Power Distribution Group Work Order Job # 04-07-03, (EWP SS2004-134), July 1, 2004, Dismantle Conduit & Store. Install Conduit from A18 Sheave to A15 per Sketch
- Enhanced Work Permit SS2005-109, Cold Box 5 Modifications, July 13, 2005
- Cutting-Welding permit for EWP SS2005-106
- C-A-QA Action Query Results: Safety Talks, August 2005
- Critiques from C-AD web site

- Plant Engineering Tool Box Meetings: August 17, 2004; February 11, 2005; February 18, 2005; May 12, 2005
- Water Systems Group WCS Number 8/12/2005-5, Maintenance on Temp and Pressure Controllers,

**Personnel Interviewed:**

- Collider-Accelerator Department Work Control Manager
- Collider-Accelerator Department Quality Assurance Manager
- Collider-Accelerator Department Associate Chair for ES&H/QA
- Collider-Accelerator Department ESHQ Division Head
- Collider-Accelerator Department Operations Maintenance Coordinator
- Collider-Accelerator Department Technical Supervisor, Cryogenic Systems, Controls and Instrumentation
- Collider-Accelerator Department Group Leader, Facilities & Experimental Support, Power Distribution
- Collider-Accelerator Department Group Leader, Electrical Systems, Collider Electrical Power Supplies
- Collider-Accelerator Department Technician, Facilities & Experimental Support, Water Services Group
- Collider-Accelerator Department Technical Specialists (2), Electrical Systems, Collider Electrical Power Supplies
- Radiation Control Division Facility Support Representative for C-AD
- Union Plumber

**Work Observations:**

- Collider-Accelerator Department Maintenance Supervisors' Meeting, 08/18/2005
- Walkthrough of Collider-Accelerator Department, Buildings 912, 957, and STAR Experimental Hall, 08/22/2005
- Valve Repacking by Water Systems Technician, Building 959, 08/24/2005
- Electrical Sub-Contractor Working on the Linear Accelerator Cooling Tower, 08/24/2005
- Quench Protection Assembly Modification/Upgrades, Building 1007 W, 08/24/2005
- Turbine Rebuilding/Installation of Oil Filters, Building 1005R, Cryogenic Systems

**Signatures:**

---

**Lawrence E Hinchliffe**

---

**Joseph P Drago**